Farm Practices *that* INCREASE CROP YIELDS

The Gulf Coast Region

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GULF COAST REGION upland soils are ordinarily deficient in nitrogen and need to be supplied with liberal quantities of organic matter if profitable crop yields are to be produced. This condition is most easily and cheaply remedied by growing such legumes as velvet beans, cowpeas, soy beans, bur clover, crimson clover, hairy vetch, and beggar weed, and by carefully utilizing all farm manures, crop residues, and other sources of humus. By a simple readjustment most of the cropping systems followed in this region may be made to include one or more legumes which will increase the supply of nitrogen and humus in the soil and greatly increase crop yields. Systems by means of which crop yields are being increased in the region are discussed in the following pages.

FARM PRACTICES THAT INCREASE CROP YIELDS IN THE GULF COAST REGION.

CONTENTS.

THE GULF COAST REGION of Alabama, Mississippi, and West Florida is that portion of the Coastal Plain area which lies contiguous to the Gulf of Mexico (fig. 1) and is part of what is commonly referred to as the "long-leaf pine belt," having originally been forested principally with long-leaf pine. Only a small percentage of the area bordering on the Gulf is farmed, several of the counties having less than 2 per cent and none more than 6 per cent of their total areas in cleared land. Farther back from the Gulf Coast more of the land is in farms, and consequently a much larger percentage of the land is in cultivation.

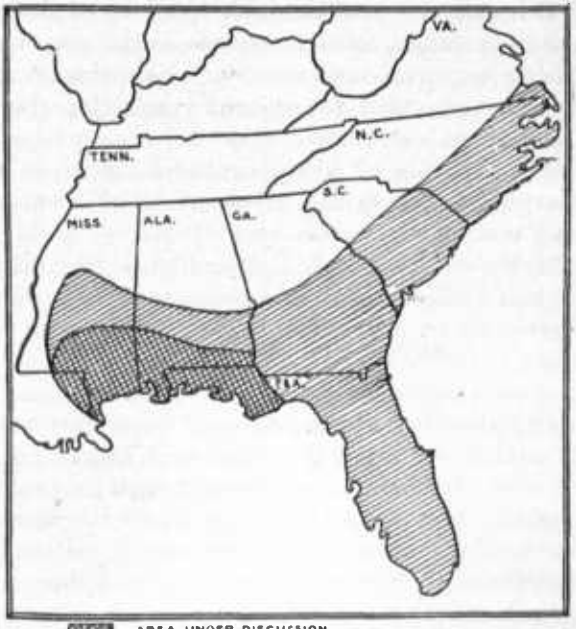

FIG. 1.—Map of Gulf Coast region.

While some sections of this area possess soils of great natural productiveness that have been farmed for several generations, over the greater portion of the area the land is either naturally low in fertility or has been made so through poor management. Cropping systems followed in the past were not suited to the maintenance of soil fertility, and in many sections crop yields have gradually decreased until they are no longer profitable. The outstanding agricultural problem of the region, therefore, is that of readjusting farm practices in such a manner as to improve the soil and increase crop yields. It is the aim of this bulletin to point out and explain some of the farm-practice methods that may be employed to bring about these desired results.

This region embraces an area which is both old and new in an agricultural sense. In some sections of this area farming has been carried on for many years, but over a large part of it, especially that portion adjacent to the Gulf, farming has been a minor occupation until within comparatively recent years. For many years lumbering and turpentining have been the principal industries over the greater portion of this section, consequently agricultural development has been slow. The earlier settlers usually located near the navigable streams, so as to have better transportation to markets. They raised practically all their home supplies, growing corn, oats, potatoes, and other food and feed crops, and cotton for a money crop. They generally kept considerable numbers of live stock, which grazed on the open range, at little expense to the owners. Land was cheap, and little or no attempt was made to maintain soil fertility. A field would be cultivated for several years, then "turned out to rest" for a few years.

With the rapid cutting off of the timber, large areas of land have been made available for farming. Some of this cut-over land is level to gently rolling and naturally well adapted to farming, while considerable areas are too rough and broken to be cultivated profitably and are best utilized for grazing purposes.

ECONOMIC CONDITIONS.

The Gulf Coast region is not especially well located as to markets, and any production in excess of local demands must be shipped to the large market centers of the North and East. For this reason the production of perishable crops, except such as can be marketed early in the season or at other times when they will command a fancy price, is a more or less hazardous undertaking, and the major crops grown should be those that are not readily perishable and can stand long transportation.

Transportation is practically all by rail, and several through lines connect this section with the large market centers of the East, North,

and Middle West. Over much of the area, however, transportation facilities are inadequate for any except nonperishable crops and only such should be grown in excess of the amount required for home use and local demand. Water transportation from Mobile and Pensacola is available to some points but is not much of a factor in the marketing of farm products.

The soils of this region are variable, ranging all the way from coarse sand with sandy subsoils to clay loams with sandy clay subsoils. The types which predominate are the fine sandy loams with sandy clay subsoil, and belong to the Norfolk and Orangeburg series, the latter being generally considered the best general farming land in the Gulf coastal region. Generally speaking, the lighter soils predominate near the coast, and farms farthest removed from the Gulf possess the largest proportion of the heavier soils. Many of the soils found in this region are not naturally productive, and most of those that were fertile when first cleared have had their productiveness greatly decreased by systems of farming which have robbed them of their original fertility.

The wide variation in soils makes the area adapted to a correspondingly large variety of crops. Some sections that are favored by suitable soil and good marketing facilities have developed along the line of fruit and truck farming, while in those sections more remote from lines of transportation, corn and cotton have been the principal crops grown until within recent years. Since the cotton boll weevil has made cotton growing too hazardous for this crop to continue as the principal farm enterprise, peanuts have largely replaced the former crop in many sections. In some of the more recently developed areas the sweet potato has become the principal money crop grown. Outside of the truck areas and some of the older settled localities, however, few sections have developed anything like well-established systems of farming. In the more recently settled sections this is due largely to the fact that farming has not been an established business long enough to have developed well-defined systems of practice, while in the older sections, where corn and cotton were for years the principal crops, the advent of the cotton boll weevil has necessitated such radical departures from the old order that present practices are in a more or less transitory stage and not well established. Both the old and the new farmers have had to do more or less experimenting with crops and methods to determine the most profitable crops to grow and the best practices to follow in maintaining crop yields.

In the past but little attention was paid to the matter of permanent soil improvement, and it was not an uncommon practice to grow corn or cotton on the same land for a succession of years with little or no attempt being made to maintain or increase crop yields, except by the use of commercial fertilizer. Some farmers attempted crop

rotation after a fashion, growing cotton three or four years, then corn for two or three years. Others varied this system by growing occasional crops of cowpeas in their corn or following a crop of oats with cowpeas. This latter practice helped in a measure, but, with a large percentage of land in cotton each year, the area in cowpeas was too small in proportion to the total number of acres in cultivation to be much of a factor in maintaining crop yields.

Now that recent interest has been aroused in the agriculture of this section and the necessity of changing from the old-time practices recognized, the question of soil management to increase crop yields becomes paramount. With the high cost of living and correspondingly high cost of labor, machinery, and other factors of production, it is imperative that crop yields must be increased or farming will become an unprofitable business. Farmers generally recognize the necessity of increased crop yields if farming is to remain profitable, consequently they are greatly concerned as to the most economical methods of soil management necessary to insure profitable yields of crops.

Summing up the present situation with reference to crop production in the Gulf Coast region, we find that the more fertile soils that have been under cultivation for some time have gradually become less productive, and will continue to do so unless measures are adopted to increase their fertility. The more fertile soils recently brought under cultivation can be made to continue producing profitable yields from the first if proper measures are employed to maintain and increase soil fertility, but many of the poorer soils are so infertile to begin with that they have to be built up and improved before profitable crops may be produced. That the greater portion of this area that is suited for farming can be made productive by better soil management and proper attention is clearly shown by a number of practical examples of farmers who have attained this desired end. The practices of these farmers may well be used to guide others who are confronted with the problem of maintaining soil fertility to such a point as will make farming a profitable business in this section.

PRACTICES IN INCREASING CROP YIELDS.

In actual practice there is quite a wide variation in the methods followed by the more successful farmers in maintaining crop yields in this region. The practice followed depends largely on the character of the soil, type of farming followed, crops grown, and kind of fertilizer used. These practices may be divided among the following groups:

1. Farmers who depend largely on commercial fertilizers as a means of maintaining crop yields. This was the most common

method in the past, especially where cotton was the principal crop grown, and the practice is still adhered to by many farmers.

2. Farmers who have adopted the practice of depending largely on plowing under leguminous crops grown primarily for the purpose of increasing soil fertility and who use little or no commercial fertilizer.

3. Those who combine the above two methods, depending on the use of legumes to keep the land supplied with humus and maintain soil fertility, and who use commercial fertilizer to supplement these in increasing the yields of crops.

4. The intensive truck growers who depend largely on animal manures and commercial fertilizers for maintaining crop yields. With their land occupied with a succession of growing crops practically the entire year they can not afford to lose the use of their land for the several months that would be required to grow a crop for soil improvement, so they depend on animal manures to keep up the supply of organic matter in their land, and also use liberal amounts of commercial fertilizers to insure profitable yields. The greater portion of the manure thus used is shipped in from the stockyards of St. Louis and New Orleans.

In general, however, farm experience shows that the incorporation of large quantities of vegetable matter into the soil is the principal factor in building up and maintaining soil fertility in this section, and any system of farm practice which fails to recognize this will fail in maintaining crop productiveness to a point that insures profitable farming. The presence in the soil of an abundance of humus is most important to crop production for several reasons. This decayed vegetable matter not only increases the amount of plant food, but also increases the water-holding capacity of the soil, lessens the danger of soil erosion, improves the physical condition of the soil, makes a home for necessary soil bacteria, and acts as a storehouse for plant food.

The soils of this section are generally deficient in nitrogen; consequently many of them are so infertile as to be incapable of producing profitable crops without the aid of fertilizers. This deficiency in nitrogen is evident not only on land that has been in cultivation for some time but also on much of the land that is freshly cleared, and is due to a lack of organic matter in the soil. It is a well-known fact that even in their virgin state many of the lighter soils are incapable of producing profitable crops until they have been subjected to a cropping system which adds to the supply of organic matter. This condition has been brought about in two ways: First, by a long-continued practice of burning over timbered land, pastures, etc., in the spring to stimulate the early growth of grass for grazing, and by burning off corn and cotton stalks, weeds, grass, stubble, and other vegetable matter in cultivated fields to lessen the labor of breaking the land. Second, the climatic conditions of this region are such as to encourage a rapid exhaustion of the organic matter in the soil.

The high average temperature and humidity greatly hasten the process of decomposition, and the mild winters offer no material check to this process, as is the case in those sections where cold weather prevails for several months of the year.

Many of the soils are also more or less deficient in phosphorus, and on these phosphatic fertilizer in some form is necessary for economical crop production. Over most of this region, except in the eastern extremity, there is sufficient potash present in the soil for ordinary crop needs, and the use of potash fertilizers is not necessary except in the case of potatoes or other special crops.

All studies and investigations tend to show that organic matter is the greatest essential of soil fertility in this section. It is most easily and cheaply added to the soil by means of (1) animal manures, (2) crop residues, and (3) special crops grown primarily for soil improvement. No vegetable matter that can be turned under should be burned or destroyed, but all stalks, leaves, straw, weeds, or other sources of humus should be plowed under. With the comparatively small number of live stock kept on the average farm of this section, available stable manure and crop residues alone are not sufficient to supply the humus requirements of the soil, hence it becomes necessary to grow special crops to be grazed off or plowed under for soil improvement.

ANIMAL MANURES.

On the majority of farms in this section the amount of animal manures produced is not sufficient to be a vital factor in maintaining crop yields. First, the amount of stock kept is small in proportion to the acreage of land in cultivation. Second, with the exception of the work stock, most of the farm animals are running on pasture or on the open range for the greater portion of the year, thus making it possible to save only a small proportion of the manure actually produced. However, the small percentage of animal manure that can be saved should be carefully husbanded and utilized in supplementing other sources of organic matter for soil improvement.

One of the best ways to use animal manure in this region is in getting a start with crimson clover, vetch, and other leguminous crops that require artificial inoculation. Farm practice shows that even a very light application of manure is of great value in securing a successful inoculation of some of these crops, and not infrequently means the difference between success and failure with a leguminous crop that is being grown on the land for the first time.

Since the animal manure supply is inadequate, it is necessary to resort to other means of getting organic matter in the soil, for even where considerable quantities of manure are produced and returned to the land, as is the case on some dairy farms, practical examples go

to show that the plowing under of other organic matter is absolutely necessary for the maintenance of soil fertility to a point where crop yields can be increased.

CROP RESIDUES.

Where such crops as velvet beans, soy beans, cowpeas, vetch, peanuts, etc., are grazed off, large quantities of organic matter are returned to the soil. From a soil-fertility standpoint, this practice of grazing off such crops is an excellent one, as in this way a good return is derived from the live stock grazed, and but little of the fertilizing material in the crop is removed from the field where it is grown. The roots and stubble from grain and hay crops, and the roots, stalks, and leaves from such crops as corn and cotton, while insufficient to keep up the required amount of humus in the soil, are nevertheless important sources of organic matter and should be plowed under rather than burned off, as has been the too-common practice. The grass and weeds which come up between the rows of intertilled crops after the last cultivation will furnish considerable humus if plowed under. Every possible source of organic matter should be utilized to increase the humus in the soil. If this practice is consistently carried out it will aid materially in the work of maintaining and increasing crop yields.

CROPS FOR SOIL IMPROVEMENT.

As previously mentioned, practically no farms in this region maintain enough live stock to make animal manures alone a dependable factor in supplying the soil with the humus necessary to maintain crop yields; consequently the farmer must rely upon green-manure crops for the maintenance of profitable yields. Productiveness of the soils of many farms of this region may be materially increased at once at a small expense of money and labor by simply changing the cropping system so as to include crops grown for the purpose of increasing the amount of humus in the soil. Other soils are so poor that they will require the plowing under of several such crops before a sufficient amount of humus has been accumulated to insure profitable yields. While this latter method often requires time for satisfactory results it is the only practicable means by which the poorer soils can be made profitably productive.

The Gulf Coast region is fortunate in being adapted to the growing of a wide range of crops, especially legumes, which may be used to good advantage for soil improvement. Climatic conditions are also such as to permit of growing two or more crops on the same land each year. This is a decided advantage from the standpoint of soil improvement, as it enables the farmer to grow one or two soil-improvement crops as well as a money crop on his land each year,

and thus greatly hasten the work of accumulating a mass of humus in his soil.

While any crop which returns a quantity of vegetable matter to the soil is valuable in increasing crop yields, the use of legumes (clovers, beans, etc.) for this purpose has the added advantage of supplying large quantities of nitrogen in a form readily available for the use of the succeeding crop. Although nitrogen is the most costly element of plant food when purchased in the form of commercial fertilizer, it is easily and cheaply acquired by growing legumes, and a proper arrangement of the cropping system will keep the soil well supplied with humus. This section is also favored in that there are several winter legumes which can be grown for soil improvement. This makes easy the adoption of a cropping system which permits of having a growing crop on the land nearly all the time and the growing of one or more leguminous crops on the land each year. Furthermore, with the great variety of crops that may be utilized for soil improvement in this section, the work of increasing the humus in the soil may be conducted without materially changing the prevailing cropping system or losing the use of the land for a season.

VELVET BEANS.

The velvet bean unquestionably heads the list of crops that may be used for soil improvement. It will succeed on practically all the soils of this region, makes a good growth on poor land, and

FIG. 2.—Thirty-one bushels of corn per acre, and tons of velvet beans to be grazed off or cut up with a disk and plowed under.

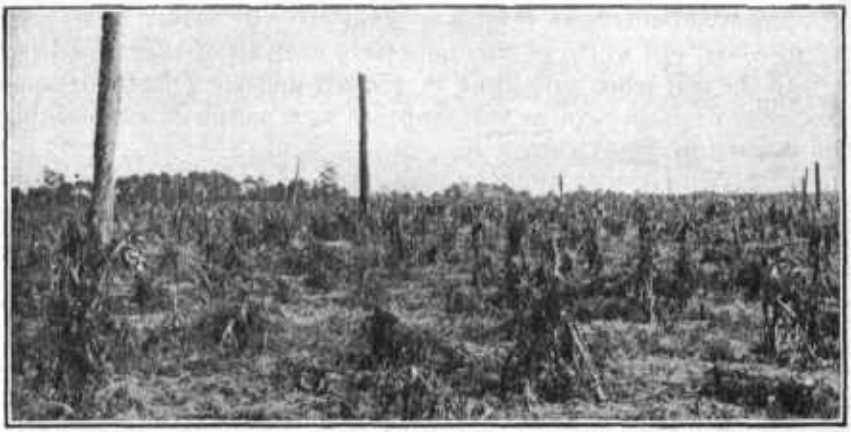

FIG. 3.—After harvesting the corn, gains of 225 pounds of live beef and pork per acre were made here by grazing off velvet beans, with a large amount of vegetable matter left to be plowed under.

produces a greater amount of vegetable matter to be returned to the soil than any other crop suitable to the region. In addition, it is one of the best grazing crops that can be had for cattle and hogs in late fall and early winter, and is also a good money crop when grown for seed or to be ground into velvet-bean meal. The velvet bean, therefore, answers a double purpose in that, if it is properly utilized, it will increase the farm income and greatly improve the soil at the same time. Over most of this section this crop should be the principal reliance for building up the soil, as it is easy and inexpensive to grow and produces quicker results than any other crop adapted to the soil and climatic conditions of this section.

The velvet bean is grown alone or in combination with corn or other crops. Except on rich land, it is always advisable to plant velvet beans with corn unless the latter is grown for silage. The heavy growth of beans interferes to some extent with the gathering of corn, but when grazed off with hogs and cattle after the corn crop is harvested, any ears of corn that have been missed in gathering will be utilized by the stock, and practically no waste result. On rich land the velvet beans are likely completely to smother the corn and make it practically impossible to gather the corn crop. Under such conditions it is preferable to use cowpeas or soy beans in the corn unless the whole crop is to be hogged off.

To secure the full benefit of velvet beans enough live stock should be kept to graze off the crops after the corn has been harvested. A good stand of beans will carry about one steer and two hogs per acre for from three to four months with no other feed, or from four to five months if the beans are supplemented with other feed. When velvet beans are grazed off in this manner practically all the fertilizing material in the crop is returned to the soil. At the present price

of commercial nitrogen (1918), a good crop of velvet beans will supply about $50 worth of this important element of plant food per acre to the soil when grazed off or plowed under. This gives some idea of the immense value this crop has as a means of maintaining and increasing crop yields.

Besides being grown alone or with corn, velvet beans are also frequently used in other combinations for grazing. Some farmers make a practice of growing corn, velvet beans, and peanuts in alternating rows, or growing corn and peanuts in alternating rows and then planting velvet beans either in the corn or peanut row. (Farmers' Bulletin 962 fully discusses velvet beans.)

COWPEAS.

The cowpea was one of the first crops used for soil improvement in this section. Like the velvet bean, cowpeas will grow on most of the soils of this section and will succeed on soil low in fertility. Of the crops used for this purpose the cowpea probably ranks next to the velvet bean as a soil improver for the soils of the Gulf Coast region. While this crop will grow on practically any of the soils of this section, some of the less fertile types that are very deficient in organic matter fail to produce a satisfactory growth without an application of some kind of phosphate. In general, however, cowpeas may be

FIG. 4.—A catch crop of cowpeas sown in corn at the last cultivation aids materially in maintaining soil fertility.

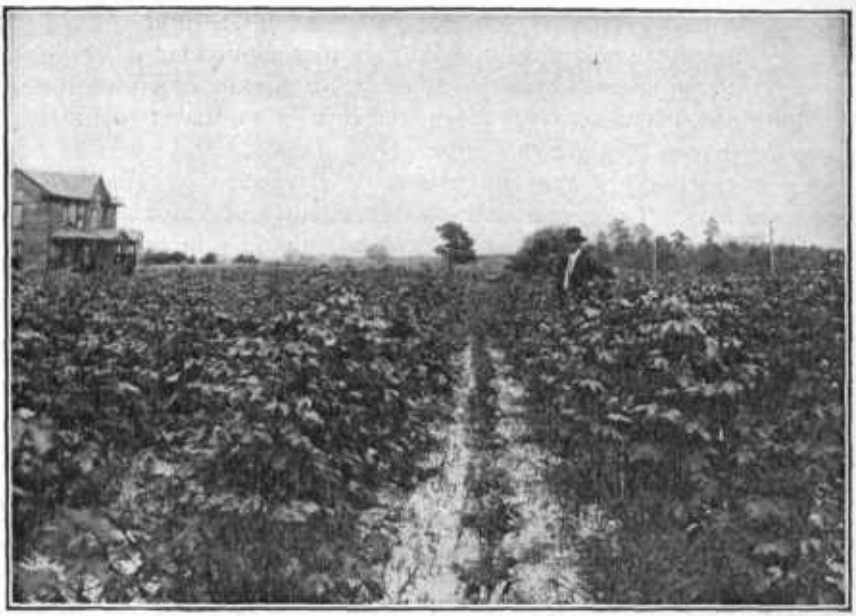

FIG. 5.—Intercropping cotton with cowpeas on light sandy land enables the farmer to increase the supply of humus in his soil and at the same time have the land producing a money crop.

relied on to increase soil fertility, and are very valuable in this connection in that they can be made to fit into almost any cropping system. They may be grown after a crop of oats, early sweet potatoes, Irish potatoes, or some other truck crop has been removed; as a catch crop in corn or other intertilled crops; or in combination with sorghum, millet, or other crops for a hay or grazing crop. (Farmers' Bulletin 318 gives a full discussion of the growing of cowpeas.)

SOY BEANS.

The soy bean, while not so well known or extensively grown as the cowpea, ranks close to the latter in usefulness as a source of soil improvement in this region. Soy beans do not succeed as well as cowpeas on poor land, but on fairly fertile soils are equal if not superior to the latter both as a money and feed crop. They are more easily handled than cowpeas, either as a hay or seed crop, and the yield of seed is usually considerably more than that of cowpeas.

On land where soy beans have never been grown, satisfactory results are seldom obtained the first year unless artificial inoculation is resorted to.[1] Growing the crop two years in succession on the same

[1] Seed dealers will furnish material for inoculating the seed, or the culture may be obtained free, in small quantities, from the U. S. Department of Agriculture. Where soil from a field where soy beans have grown is available, a good way to inoculate is to scatter this soil over the field to be planted to soy beans. From 200 to 500 pounds of dry earth should be applied per acre, the quantity varying according to the care with which the earth is broadcast. This should always be done when the sun is not shining.

land will usually give the desired inoculation, and a light application of animal manure will aid materially in this connection. Soy beans do not usually succeed well when sown broadcast, and best results are obtained when they are planted in rows so that two or three cultivations can be given.

Soy beans make a very nutritious hay, relished by all kinds of farm animals. They also make an excellent and valuable grazing crop for hogs, and when thus utilized will rapidly increase soil fertility. Soy beans are better adapted to being grown with corn for silage than either cowpeas or velvet beans, as they are upright in growth and do not tangle up the corn. This is a crop worthy of a much wider use in this section. (Farmers' Bulletin 372 gives further details regarding the soy bean.)

BUR CLOVER.

Bur clover is a winter-growing legume well adapted to many of the soils of this region, but, owing to lack of more general knowledge of its real economic value, it is but little grown. It has found greatest favor as a grazing crop in permanent pastures, and as a winter cover crop and soil improver where the land is in clean-culture crops during the summer. Under normal conditions bur clover sown early in the fall will make considerable growth during late fall and early winter. It makes rapid growth after the weather warms up in the spring, and matures its seed in May. It succeeds best on the heavier loams and clays, and instances are on record where it has more than doubled the yield of corn and cotton in a few years. A strong point in favor of its use is its habit of reseeding itself. When mature the seed burs fall to the ground and the plants die. The ground may then be broken and planted to a summer crop. The seeds remain dormant through the summer, but germinate and come up in early fall when the fall rains come in. (Farmers' Bulletin 693 gives further information regarding bur clover.)

VETCH.

Vetch is another crop which, though adapted to conditions existing in this section, has never gained much prominence. It does not succeed well on poor land, but on soils that have been built up to a reasonable state of fertility it has proved to be a valuable crop, both for hay and for keeping up soil fertility. Like bur clover it is a winter-growing legume, and when once established is valuable both for grazing and to prevent soil erosion and the leaching away of available plant food during the winter months. It is best sown in the fall with oats or some other winter cereal, and this combination makes

an excellent hay crop. In getting a stand with vetch, inoculation is absolutely necessary. As with soy beans, a light application of stable manure is usually invaluable in this connection. (Farmers' Bulletin 529 gives detailed information relative to the growing of vetch in the South Atlantic States and may be used as a guide for this section.)

CRIMSON CLOVER.

Crimson clover has never occupied an important place in the cropping systems of the Gulf coast region. Results secured by farmers who have grown the crop, and its use in other sections where more or less similar conditions prevail, would seem to indicate that it is worthy of a much wider use in this section. Crimson clover is not successful on soils that are low in fertility, and for this reason it should not be sown on land that is not well supplied with humus. On soils that have been made reasonably fertile by increasing their supply of humus it is a very valuable crop to assist in keeping up the standard of fertility and increasing crop yields. (Farmers' Bulletin 550 discusses the growing and management of this crop in the South Atlantic States, and may be used as a guide to those who wish to grow the crop in this section.)

PEANUTS.

During recent years the peanut has increased in importance in this section not only as a revenue-producing crop to supplement or take the place of cotton but also as a means of maintaining soil fertility. While very profitable as a money crop under present conditions, the continuous growing of this crop for sale will deplete rather than increase soil fertility, for the methods of harvesting are such that nearly all the crop is removed and but little returns to the land. To be of value as an aid in maintaining soil fertility the crop should be grazed off with hogs, and in some sections the farmers are depending almost entirely on this practice to keep up the supply of humus in the soil. Several methods are practiced in growing peanuts for grazing. Some grow the crop in solid areas, but by far the most common practice, when peanuts are grown for increasing soil fertility and as a grazing crop for hogs, is to plant them in alternate rows with corn and graze them off after the corn has been harvested. Others follow the practice of growing peanuts, corn, and velvet beans together for grazing purposes. This system has the advantage of returning a greater amount of vegetable matter to the soil than if peanuts alone were grown. (Farmers' Bulletin 431 discusses in detail the methods of growing and handling the peanut crop.)

BEGGAR WEED.

Beggar weed—or Florida beggar weed, as it is frequently called—is another legume that has been used to maintain crop yields. Sown in corn or other cultivated crops at time of the last cultivation it will come on and make a rank growth of vegetation to be grazed off or plowed under. It also makes a valuable and nutritious forage, as it contains a high percentage of protein and is relished by all kinds of stock. Beggar weed also has the fortunate habit of reseeding itself, and when once established will come on year after year after intertilled crops have been laid by. One farmer in Barbour County, Ala., has grown beggar weed in corn for the past seven years and

FIG. 6.—Florida beggar weed on light sandy land increased the yield of corn from 10 to 25 bushels per acre in five years.

during this time his corn yields have increased from 10 to more than 25 bushels to the acre. The corn has been grown on the same land each year, and no fertilizer except beggar weed has been used. The corn is planted in March and laid by early in June to give the beggar weed a chance to get a good start.

LESPEDEZA, OR JAPAN CLOVER.

Lespedeza, or Japan clover, is valuable in soil-improvement work on certain soils of this region. While not generally used as a regular farm crop, it is becoming well distributed over this area, and in some sections is of considerable importance in building up soil fertility. While it will make some growth on practically any kind of land, it thrives best on moist, fertile soils. Lespedeza reseeds itself and comes up on most of the uncleared cut-over land and fields that are lying idle. Its value as a soil improver is due more to its habit

of reseeding itself and the large amount of nitrogen it collects and leaves in the soil than to the amount of organic matter it supplies. (Farmers' Bulletin 441 gives a detailed discussion of the management of this crop.)

OATS.

This crop is grown in a limited way on many farms of this region. While sometimes sown in late winter, most of the oats are sown in the fall, and the fall-sown crop usually succeeds much better. Fall-sown oats make a good winter cover crop and furnish valuable grazing, especially for young pigs. When oats are grown as a winter cover crop or for grazing, the addition of vetch or crimson clover is a material aid in maintaining soil fertility. On fertile lands oats produce good yields, and the straw, if returned to the land, adds considerably to the supply of humus.

RYE.

This crop is not so generally grown as oats in this section, but fills about the same place in the cropping system. Some farmers prefer rye, especially the Abruzzi variety, to oats as a crop for winter grazing. Rye is hardier than oats, and a good crop will generally furnish more vegetable matter to be turned under for soil improvement. The expense of seed for planting and the smaller yield make this crop generally less desirable than oats as a grain crop.

COMMERCIAL FERTILIZERS.

Commercial fertilizer acts as a stimulant on plant growth and increases crop yields. Its influence is temporary, however, and the continued use of mineral fertilizers alone, if accompanied by a decrease in organic matter, tends to lessen the productiveness of the soil. Farm-practice studies indicate that the farmers who are accomplishing best results with commercial fertilizers are those who are depending mainly on a high percentage of vegetable matter in the soil to maintain crop yields and using commercial fertilizers to balance the fertility of the humus in their soil. These farmers often use some commercial fertilizer to stimulate the growth of crops that are to be used for soil improvement and thus hasten the process of filling the soil with organic matter.

When the process of soil improvement is well under way and considerable vegetable matter has been added to the soil, the greater portion of the commercial fertilizer should be used on the crops grown for revenue. Under most conditions soil-improvement crops can be grown with little or no commercial fertilizer, and the richer the soil is in humus the greater will be the benefits derived from the use of phosphate and potash.

The greatest needs of the soils of this region are for nitrogen and humus, and the full benefit of other elements of plant food can not be secured and profitable crops grown until these requirements have been met. Nitrogen, as already pointed out, is most easily and cheaply secured by the growing of leguminous crops and the plowing under of quantities of vegetable matter, and by a careful saving and utilization of all animal manures produced on the farm. However, the use of nitrate of soda on corn, cotton, oats, and many other crops is often good economy, especially if these crops are being grown on soils that are deficient in humus.

Next in importance to nitrogen and humus comes phosphorus, and this is most commonly supplied in the form of acid phosphate. Under certain conditions some prefer to use raw rock phosphate, especially where a heavy growth of vegetation is plowed under for soil improvement. The use of phosphate slag is beginning to attract attention, and some prefer it to either acid phosphate or the raw rock phosphate. The latter contains nearly 50 per cent of lime, which is beneficial to many crops on these soils. On many soils, especially when beginning the process of soil improvement, it is advisable to use phosphate in some form on cowpeas and some of the other leguminous crops that are to be plowed under for soil improvement.

Under normal conditions the use of some potash would be recommended in the eastern part of this region, but the present high price, together with the difficulty of obtaining potash, makes its use at this time of doubtful economy except in the case of specialized crops or where needed to balance a soil that has been made rich in nitrogen.

Some of the soils here are benefited by applications of lime, especially where masses of green vegetation are plowed under. Lime hastens the process of decomposition in the vegetable matter turned under and also corrects acidity in the soil. In some soils the lime contained in phosphate slag or raw rock phosphate will be sufficient for the general needs.

CROPPING SYSTEMS.

The cropping systems that may be adopted for soil improvement in this section are extremely varied, and may be planned to suit practically all types of farming. It would be a comparatively easy matter to outline a cropping system which will add a maximum amount of humus to the soil, if this were the only factor involved, but in beginning the work of soil improvement we have other economic factors that have to be taken into consideration. For example, we have to consider the problem from the standpoint of the "poor man on poor land," and under such conditions any cropping system planned must be inexpensive at the start as well as immedi-

ately effective in results. As a rule, farmers living on poor land have very little capital and must derive some return from their land while the soil-improvement work is going on; for, were they to adopt a system of cropping containing few crops aside from those grown for the express purpose of increasing the fertility of the soil, little or nothing would be left for living and operating expenses. The simplest system of improvement for such conditions is to grow but one major crop, such as corn or cotton, and another crop for soil improvement.

INTERCROPPING.

Intercropping with legumes—that is, growing some leguminous crop between the rows of intertilled crops, such as corn or cotton—is the simplest system of growing crops for soil improvement. This practice is an inexpensive and easy means of increasing crop yields, yet, while common in many sections, it is not followed to the extent it should be. The continuous growing of any one intertilled crop on the same land for a succession of years is not good farm practice; but where this is the custom, as is the case in many sections, the practice of intercropping with legumes will frequently keep a sufficient supply of humus in the land to maintain crop yields.

Intercropping corn.—Corn lends itself better to the practice of intercropping than any other crop of this region, and it is with the corn crop that the greatest possibilities are offered for soil improvement by this system. Crops used in this region for intercropping corn are cowpeas, soy beans, peanuts, velvet beans, and beggar weed. These crops are grown in several different ways. Cowpeas are either drilled in between the corn rows or sown broadcast at the time of last cultivation. On thin land it is sometimes the practice to plant corn and cowpeas in alternate rows. Soy beans are seldom sown broadcast in corn, but are usually drilled in between the rows, or planted in alternate rows with the corn. Beggar weed is sown broadcast. The latter crop reseeds itself, coming on year after year when allowed to mature seed and no effort is made to exterminate it. Peanuts are grown in rows alternating with corn, and should be grazed off with hogs if they are to be of value in increasing soil fertility. This practice of intercropping corn with legumes is one of the cheapest and easiest methods of increasing soil fertility, and should be generally followed in this region.

Intercropping cotton.—Cotton is not so well adapted to being intercropped as is corn. This is due to the fact that the cultivation of the cotton crop extends over a much longer period than that for corn, and that any interplanted crop interferes more or less with picking the crop. Soy beans and cowpeas of erect, or semierect, habit of growth, are the best crops with which to intercrop cotton. Where cotton is intercropped with legumes it is usually on thin land,

the farmer wishing to secure some revenue from his land while the soil-improvement work is going on. The cotton is usually planted in wide rows and the legume drilled in the middles after the second or third cultivation, or the cotton and legume are placed in alternate rows of usual width. (See fig. 5.) Where the latter practice is followed the rows are reversed the following year and cotton planted in the legume row of the previous year. Another method is to plant the middles of alternate rows of the cotton field to cowpeas or soy beans at the last cultivation. This method, by leaving every alternate middle free, enables the pickers to work without interference.

WINTER COVER CROPS.

The work of building up soil fertility may proceed even more rapidly with the addition of a winter cover crop to the intercropping system, thus providing for the growing of two soil-improvement crops on the land each year. Crops suited for winter cover crops in this region are bur clover, crimson clover, vetch, oats, and rye. With cotton it is possible to have a winter cover crop on the land each year and grow cotton continuously year after year. The crop best suited to this purpose, especially on the heavier soils, is bur clover. Owing to the fact that it reseeds itself, when once estab-

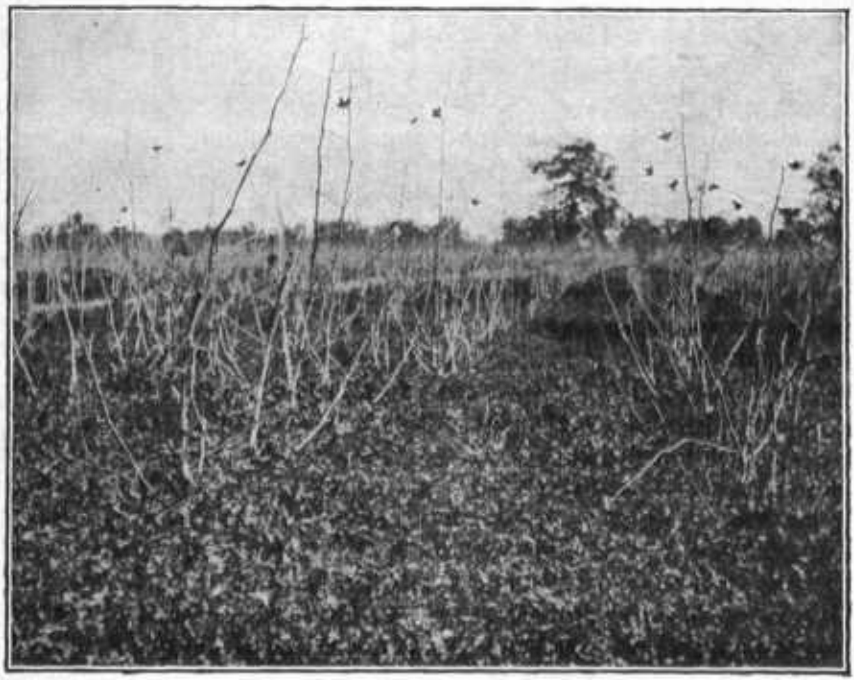

FIG. 7.—Bur clover as a winter cover crop on cotton land increased the yield of lint cotton from one-third of a bale to nearly 2 bales per acre in a few years.

lished, bur clover will, under normal conditions, come on year after year with no additional expense for seeding.

One objection to this practice of growing continuous cotton with bur clover as a winter cover crop is that if the bur clover is left to mature its seed before the land is broken, it delays the preparation of the land and planting of cotton in the spring, a condition which should be avoided, especially where the cotton boll weevil is present. This objection is overcome to some extent by bedding the land so as to leave between the beds a "balk" or unbroken strip of land on which the clover is left to mature seed. The cotton is planted on the beds at the usual time, and when the clover on the balks is mature these are broken out and cultivation proceeds in the usual manner. Bur clover grown as a winter crop in this manner has increased the yield of lint cotton from one-third of a bale to over one and one-half bales to the acre in eight years. (See fig. 7.) Under boll-weevil conditions it is better to practice a more general crop rotation and not plant cotton on the same land for a succession of years.

CROP ROTATIONS.

When a broader crop rotation is practiced crimson clover, vetch and oats, or vetch and rye may be utilized to good advantage. When crimson clover can be grown it is one of the best winter cover crops to precede corn. Vetch, when grown with oats or rye, makes a good hay crop and may be followed by late corn, late sweet potatoes, soy beans, peanuts, or other crops.

In beginning the work of soil improvement there is no better crop to use in this section than velvet beans. This is true both from the standpoint of economy and the rapidity with which results may be obtained, for velvet beans not only produce an immense amount of vegetable matter to be returned to the soil, but they are cheaply and easily grown and differ from most crops grown for the express purpose of plowing under for soil improvement in that they are also a valuable crop for grazing or the production of seed. Furthermore, they may be grown with corn with little detriment to the latter crop. Frequent intercropping with velvet beans should continue until the soil is well filled with humus, and the rapidity with which the work of soil improvement may be carried on will depend largely on the proportion of his land the farmer can devote to this crop each year.

Some of the most successful farmers in this section plant about two-thirds of their cultivated land to velvet beans each year, and in most cases it is advisable to plant at least half of the cultivated land to this crop every year. The land that is not in velvet beans is utilized for the production of other crops that suit local demands and conditions. When the soil is very poor and unproductive the

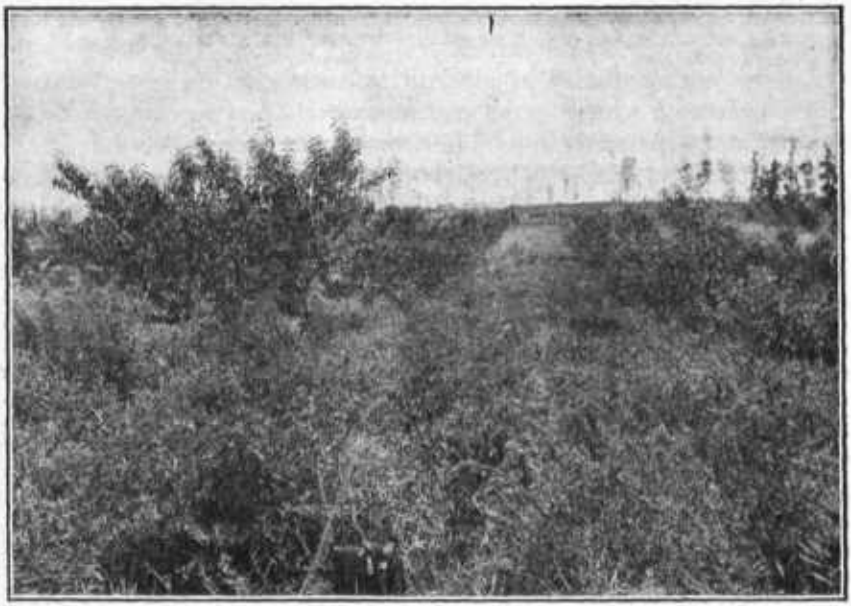

FIG. 8.—Hairy vetch on light sandy land furnishes winter grazing, a good crop of hay, or a large amount of vegetable matter for soil improvement.

practice of planting two-thirds of the crop land to velvet beans each year is preferable. A good 3-year cropping system for such conditions would be as follows:

First and second years	Corn and velvet beans.
Third year	Cotton, followed by a winter cover crop. Peanuts, followed by a winter cover crop. Sweet potatoes, followed by a winter cover crop. Oats, followed by cowpeas or soy beans.

Under this system two-thirds of the land is in corn and velvet beans each year, and the remaining third can be devoted to revenue-producing or food crops. The common practice is to harvest the corn and then either graze off or plow under the velvet beans. The practice of grazing off the velvet beans is preferable where live stock is available for the purpose, as a revenue will be derived from the live stock thus fed, and in addition the tramping of the stock will cut up the heavy fibrous vines that are not eaten and make them easier to plow under. (See fig. 3.) Where the velvet beans are to be plowed under without having first been grazed off, it will frequently be necessary to cut them up with a disk harrow or other means to facilitate the work of turning under the great mass of vegetation. The acreage of the money crops may be adjusted to suit local conditions and marketing facilities. In some sections part of the land should be in cotton or peanuts, part in sweet potatoes, and part in oats. The cotton, peanuts, and potatoes may be followed by a winter cover crop, and the

oats by cowpeas or soy beans for hay, and these crops in turn may be followed by a winter cover crop. This rotation allows for the growing of from one to two soil-improvement crops on the land each year. Under such a system as this, crop yields will not only be maintained but will be increased from year to year, especially if small applications of fertilizer be used to balance the nitrogen that will be accumulated in the soil.

On soils that are naturally more fertile, or that have been made so through the above or some similar cropping systems, the area devoted to velvet beans for soil improvement may be decreased, if so desired, or, if economic conditions justify, increasing the acreage of other crops. This does not necessarily involve any marked change other than adjustment in the acreages devoted to the different crops. Velvet beans may be planted on half of the land each year, but otherwise the cropping system may remain the same as in the previous rotation. Such a crop rotation would be as follows:

First year	Corn and velvet beans.
Second year	Cotton, peanuts, sweet potatoes, Irish potatoes, etc., followed by a winter cover crop.
	Oats, followed by cowpeas or soy beans for hay.

In this system, as in the previous one, the acreage devoted to the different money crops is adjusted to suit local conditions. Where cotton has become too great a risk the greater portion of the area may be planted to peanuts, sweet potatoes, or such other crop as marketing facilities, labor supply, etc., seem to justify.

A successful farmer in Baldwin County, Ala., who combines live stock with the production of general farm and truck crops, follows this system, except that he grows no cotton. He has two-thirds of his land in velvet beans each year and the other third in such crops as sweet potatoes, Irish potatoes, etc. He specializes in farm seeds and sweet-potato plants. He uses a liberal amount of fertilizer on his corn and potatoes, but none on velvet beans. The corn is harvested and the beans then grazed off with hogs and cattle. Hogs are turned on first to clean up any corn missed in gathering the crop, and cattle are turned on about two weeks later. One acre of velvet beans carries two hogs and one steer from 3 to 4 months, with no other feed, or about one month longer when supplemental feed is given.

The practice followed on this farm has been productive of good results and crop yields are increasing each year. During the five years this system has been in operation corn yields have been increased from 15 to 35 bushels, velvet beans from 10 to 20 bushels, and other crops in like proportion. The slogan on this farm is, "Keep the soil full of humus and use liberal amounts of fertilizer on money crops."

ROTATION FOR CONTROL OF ROOT-KNOT.

In some sections of this area cotton, certain legumes, and many truck crops are affected by a disease known as root-knot. The cause of this trouble, a minute eelworm or nematode, lives in the soil, but unless the roots of suitable plants from which it may derive nourishment are present it will eventually be starved out. Thus in sections where root-knot occurs, a rotation of crops which will starve out the cause of the malady is necessary, both to lessen the danger of loss from the disease and also to maintain crop yields. Among the crops seriously affected by root-knot are cowpeas (except the Iron, Brabham, and Monetta varieties), soy beans, cotton, clover, alfalfa, vetch, sugar cane, tomatoes, cucumbers, cantaloupes, watermelons, sweet potatoes, and potatoes. Corn, oats, wheat, rye, barley, peanuts, velvet beans, beggar weed, and the Iron, Brabham, and Monetta varieties of cowpeas are either immune or highly resistant to root-knot. The continued planting of a crop subject to attack by this disease greatly encourages its spread; consequently under such conditions a cropping system should be planned to utilize resistant legumes for soil improvement and not have any crop that is susceptible to root-knot occupy the land oftener than once in every three or four years.

Inasmuch as cotton is also subject to another serious disease known as "wilt," which usually occurs on the same soils containing the cause of root-knot, it is highly advisable to plant in regions affected by either of these diseases a wilt-resistant variety of cotton when this crop is used in the rotation. Several varieties of cotton are known to be wilt-resistant, including the Dixie, which not only possesses a high degree of resistance but also yields well and is suitable to a wide range of conditions.

A cropping system that will meet these requirements is as follows:

First year	Wilt-resistant cotton, followed by oats.
Second year	Oats, followed by beggar weed or the Iron, Brabham, or Monetta variety of cowpeas.
Third year	Corn and velvet beans.
Fourth year	Peanuts.
Fifth year	Wilt-resistant cotton, followed by oats.

This cropping system allows cotton or other money crops that are apt to be affected by root-knot to be grown on the same land but once each four years, and at the same time makes ample provision for the growing of soil-improvement crops. When cantaloupes or watermelons are grown it is advisable to adjust the system so as to allow for even a greater lapse of time between crops. Some farmers make a practice never to plant these crops on the same land oftener than once in 8 or 10 years. In sections where the beggar weed is established it is often more economical to let this crop follow oats

for a hay or grazing crop than to break or disk the land and sow cowpeas.

ROTATION FOR LIVE-STOCK FARMS.

Good permanent pastures, which are important in live-stock farming, are seldom met with in this region. Bermuda grass, the foundation of most permanent pastures of the Southern States outside of the bluegrass section, does not succeed well in the Gulf Coast region except on the more fertile soils, and the establishing of Bermuda on much of the poorer land can not be successfully accomplished until the soil has been improved. On moist, low-lying soils, permanent pastures of carpet grass may be established without much difficulty. On all live-stock farms an attempt should be made to get a permanent pasture established, but the difficulty attending this on such a large proportion of the Gulf Coast region compels most farmers to depend largely on annual summer grazing crops.

Where live-stock production is the principal farm enterprise, and nearly everything produced is fed on the place, a still wider variety of crops is sometimes used so as to give a greater acreage of summer grazing crops. A 5-year crop rotation which has been productive of good results in Baldwin County, Ala., is as follows:

First year	Corn and velvet beans, followed by oats.
Second year	Oats, followed by cowpeas and soy beans.
Third year	Early peanuts, and early sweet potatoes, followed by Sudan grass for hay.
Fourth and fifth years	Lespedeza for pasture.

The corn is harvested and velvet beans grazed off, after which the land is sown to oats. The oats are harvested and followed by cowpeas and soy beans, which are grazed off. The third year the land is planted in early sweet potatoes and peanuts for money crops, and these are followed by a catch crop of Sudan grass for hay. Lespedeza is then sown and this crop pastured for two years. Commercial fertilizer is used on the corn, oats, and sweet potatoes. This system does not provide for the plowing under of as much vegetable matter as some of those previously mentioned, but owing to the fact that most of the crops grown are fed out on the place and the manure returned to the land, the supply of humus in the soil is sufficient to produce satisfactory results.

ROTATION FOR DAIRY FARMS.

Where dairying is the principal farm enterprise the growing of a larger amount of feed crops is essential. Under good management dairy farming returns a considerable amount of organic matter to the soil in the form of animal manures. The amount of humus thus

secured is not sufficient to maintain crop yields, however, and some other means of getting organic matter must be used in connection with the manure that is available for this purpose.

A good example of this is the experience of a dairy farmer on a sandy loam farm in southern Mississippi. At first the crops grown were oats for winter grazing, followed by corn and velvet beans. The corn was husked in the field and the cornstalks and velvet beans then grazed off in the fall. Nearly all the grain fed to the dairy cattle was purchased and all manure from cows and work stock applied to the land. A mixture of acid phosphate and cottonseed meal was applied to the corn crop at the rate of about 300 pounds to the acre. Under this system of management a large amount of vegetable matter was returned to the land, and the corn yields increased from year to year. Later, silos were built and soy beans instead of velvet beans were grown in the corn and the whole crop put in the silo, consequently a much smaller amount of vegetable matter returned to the soil. Since this change in cropping system took place the yield of silage has gradually decreased, and this in spite of the fact that fully as much manure and fertilizer has been used each year as previously, and no crops are grown excepting those that are fed out on the farm. The decrease is evidently due entirely to the smaller amount of organic matter returned to the soil in the form of crop residues. Another feature worthy of mention in this connection is that soil erosion has increased as the humus in the soil has decreased.

A cropping system to suit conditions of this nature is as follows:

First year	Corn and velvet beans.
Second year	One-half in corn or sorghum with soy beans, followed by oats and vetch or crimson clover.
	One-half in cowpeas or soy beans for hay, followed by oats and vetch or crimson clover.

The corn the first year is harvested for grain and the velvet beans pastured off. The land is then disked and sown to oats and vetch or rye with vetch for winter grazing. The second year corn and soy beans or sorghum and soy beans are grown for silage on part of the land and cowpeas or soy beans for hay on the balance. In the fall the land is again put in oats or rye and vetch for winter grazing. This system makes no provision for money crops and is best adapted to dairy farms that are located close to town and where the amount of land is limited. Under most conditions the production of one or more money crops in addition to feed crops is desirable, and the system may be easily modified to include these the second year.

One of the most striking examples of success in building up soil fertility is that of a negro farmer in Wilcox County, Ala., who for the past 27 years has made a living for himself and family on a farm with but 2 acres of tilled land, and during this time increased his

cotton yields from about one-third of a bale to over three bales to the acre.[1] This great increase in crop yield was brought about simply by filling the soil with organic matter, as no commercial fertilizer was used on cotton.

This land was first improved by plowing under leaves and other decaying vegetable matter secured from the woods. Cornstalks, cotton stalks, weeds, and all crop residues were plowed under. Practically everything but the lint cotton and a portion of the seed was returned to the soil in some form or other. The manure produced by a horse and two cows was carefully utilized, but the amount of this was not large, as the cows were in pasture the greater part of the year.

Cotton alone was grown on these two acres for several years. As the amount of organic matter in the soil was increased the cotton yields showed a corresponding increase. After some eight years of this intensive soil improvement the two acres were annually producing 3½ bales each. This was an increase of approximately 1,000 per cent in crop yields due to eight years of improving the land with organic matter.

Later a rotation of crops was tried, and oats, corn, and cotton grown on the same land each year. The oats were sown in September in broad rows 5 to 6 feet apart. During the latter part of February the oats

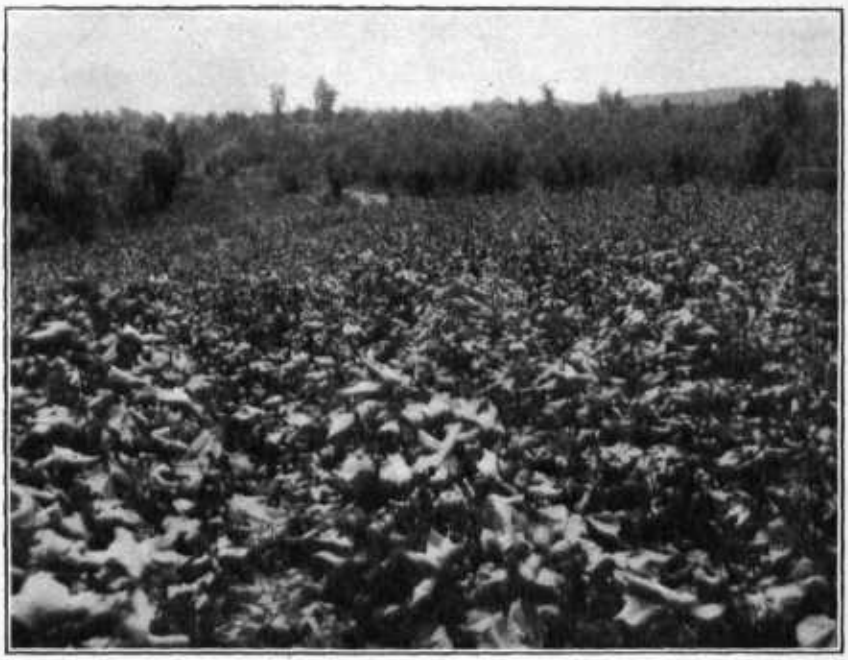

FIG. 9.—An acre field that has been built up with organic matter produced 3 bales of cotton weighing 505, 506, and 510 pounds. Furthermore, this crop was grown after oats yielding 75 bushels to the acre.

[1] Farmers' Bulletin 519 describes in detail the methods followed on this farm.

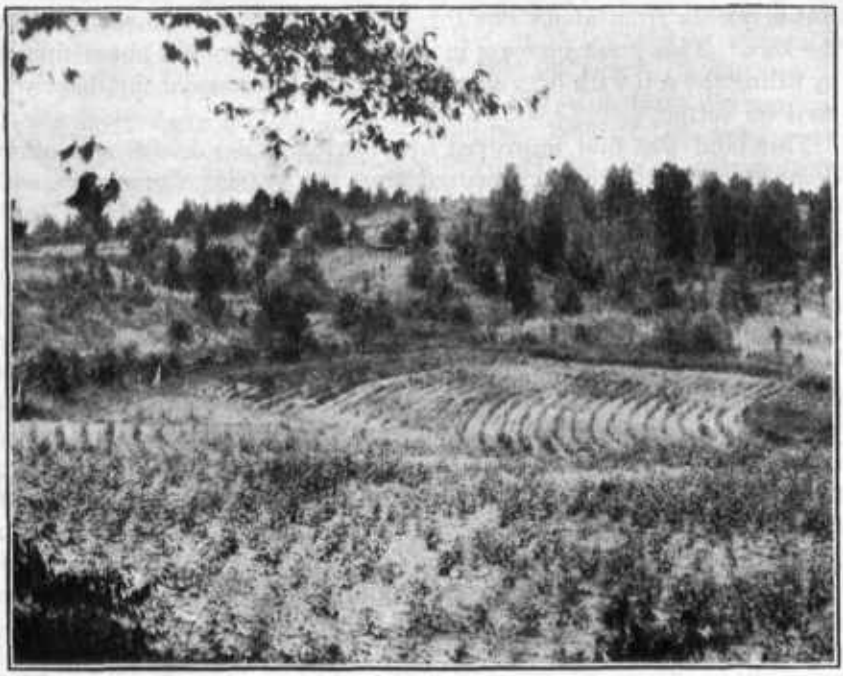

FIG. 10.—Less than 100 pounds of lint cotton to the acre on land deficient in organic matter. This field adjoins that shown in figure 9.

were given a cultivation, and about March 1 corn was planted between the rows of oats. The oats were harvested in May and the stubble immediately plowed under and the land planted to cotton. One acre managed under this system in one year produced 50 bushels of oats, 50 bushels of corn, and 1 bale of cotton. The decrease in yield of cotton was due to the fact that under this system the planting was necessarily delayed to allow the oats to mature. The other acre was planted to oats (in rows widely spaced) and cotton planted between the oat rows in April. This acre produced 75 bushels of oats and 3 bales of cotton weighing, respectively, 505, 506, and 510 pounds. (See fig. 9 and compare with fig. 10.)

The intensive methods followed on this small farm would hardly be practicable on the larger farms of this section, as it would be impossible to gather and apply to extensive areas of land a proportionate amount of decaying vegetable matter, and the cropping system followed would not be practicable on larger areas. The principle involved is fundamental, however, and applies to the Gulf Coast region and other sections of the South. This farm is cited as an example of what may be accomplished in increasing crop yields by means of filling the soil with humus, the greatest and cheapest source of soil fertility in practically all humid regions.